AIR FORCE

QUALIFICATION TRAINING PACKAGE (AFQTP)

for

ELECTRICAL POWER PRODUCTION

(3E0X2)

MODULE 13

GENERAL POWER PRODUCTION TASKS

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MODULE 13
GENERAL POWER PRODUCTION TASKS

Career Field Education and Training Plan (CFETP) references from 1 Apr 97 version.

OPR: HQ AFCESA/CEOT

Certified by: HQ AFCESA/CEO
(Colonel Lance C. Brendel)

AIR FORCE QUALIFICATION TRAINING PACKAGES
for
ELECTRICAL POWER PRODUCTION
3E0X2

INTRODUCTION

Before starting this AFQTP, refer to and read the "Trainee/Trainer Guide" located on the AFCESA Web site **http://www.afcesa.af.mil/**

AFQTPs are mandatory and must be completed to fulfill task knowledge requirements on core and diamond tasks for upgrade training. ***It is important for the trainer and trainee to understand*** that an AFQTP ***does not*** replace hands-on training, nor will completion of an AFQTP meet the requirement for core task certification. AFQTPs will be used in conjunction with applicable technical references and hands-on training.

AFQTPs and Certification and Testing (CerTest) must be used as minimum upgrade requirements for Diamond tasks.

MANDATORY minimum upgrade requirements:

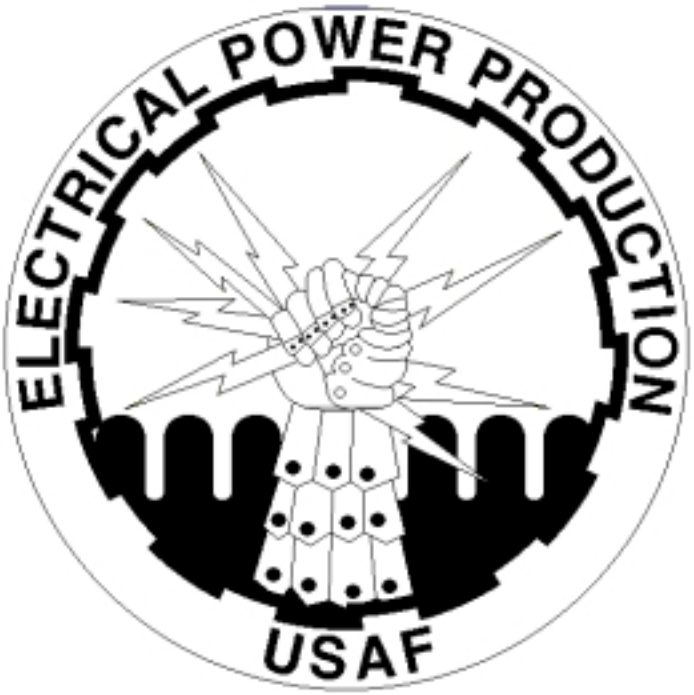
Core task:
AFQTP completion
Hands-on certification

Diamond task:
AFQTP completion
CerTest completion (80% minimum to pass)

Note: *Trainees will receive hands-on certification training for Diamond Tasks when equipment becomes available either at home station or at a TDY location.*

Put this package to use. Subject matter experts under the direction and guidance of HQ AFCESA/CEOT revised this AFQTP. If you have any recommendations for improving this document, please contact the Career Field Manager at the address below.

HQ AFCESA/CEOT
139 Barnes Dr. Suite 1
Tyndall AFB, FL 32403-5319
DSN: 523-6392, Comm: (850) 283-6392
Fax: DSN 523-6488
E-mail: ceott.helpdesk@tyndall.af.mil



EQUIPMENT DRIVE BELTS

MODULE 13 **AFQTP UNIT 2**

INSPECT (13.2.1)

ADJUST (13.2.2)

REPLACE (13.2.3)

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

INSPECT
ADJUST
REPLACE
Task Training Guide

STS Reference Number/Title:	13.2.1. Inspect 13.2.2. Adjust 13.2.3. Replace
Training References:	• 32,33,34. and 35C2 Series Technical Orders • AFI 32-1062; Manufactures Manuals
Prerequisites:	• Possess as a minimum a, 3E032 AFSC
Equipment/Tools Required:	• General Tool Kit • Applicable Technical Orders or Manufacturers Manual • Personal protective equipment
Learning Objective:	• Inspect, adjust, and replace drive belts
Samples of Behavior:	• Determine if drive belt(s) are serviceable • Determine if drive belt(s)require adjustment • Remove and/or replace as required
Notes:	
• Prior to performing any maintenance, technician MOST isolate the starting system, and apply lockout and tag-out procedures • Violation of any safety rule or practice will result in immediate failure. • The material in this AFQTP was extracted from 35C2 Series T.O. for the MEP-007B	

EQUIPMENT DRIVE BELTS
INSPECT, ADJUST, REPLACE

Background: During generator operation, drive belts are primarily responsible for maintaining proper engine temperature by operating the radiator fan and by charging the batteries via a battery charging alternator. Both are directly connected to the engine crankshaft pulley with a drive belt. Failure of either of these functions will eventually cause the generator to shutdown. Periodical maintenance inspection (PMI) is paramount in preventing equipment failure and equipment readiness. Proper belt inspection will prolong belt life and/or prevent equipment failure by allowing the inspector to adjust a belt, which is too loose, too tight or defective. Regular inspections will also allow the inspector to replace a defective belt before it causes equipment failure. Belts that are too tight will cause damage to the pulleys, bearing and or the belt itself. In a nut shell, ensuring proper belt condition will prevent equipment failure, mission degradation, and prevent you as the maintainer from having to work excessive hours under stressful conditions repairing more than just a simple belt.

This QTP has been developed using the MEP-007B as a model. Equipment may vary slightly, but the procedures are basically the same for inspecting all belts.

SAFETY:
PRIOR TO INSPECTING OR REPLACING ANY BELT YOU MUST MAKE SURE THE UNIT WILL NOT START AUTOMATICALLY. YOU MUST ALSO DE-ENERGIZE THE DC CIRCUIT BREAKER AND PLACE THE BATTLE SHORT SWITCH IN THE RAISED POSITION. THESE ACTIONS ARE REQUIRED TO KEEP THE ENGINE FROM STARTING DURING BELT INSPECTION.

EQUIPMENT DRIVE BELT INSPECTION:

Inspect Belt(s):

Step 1: De-energize DC circuit breaker and place ‘Battle Short Switch’ in the raised position

Step 2: Visually inspect belt(s) for: cracks, excessive wear, and tears

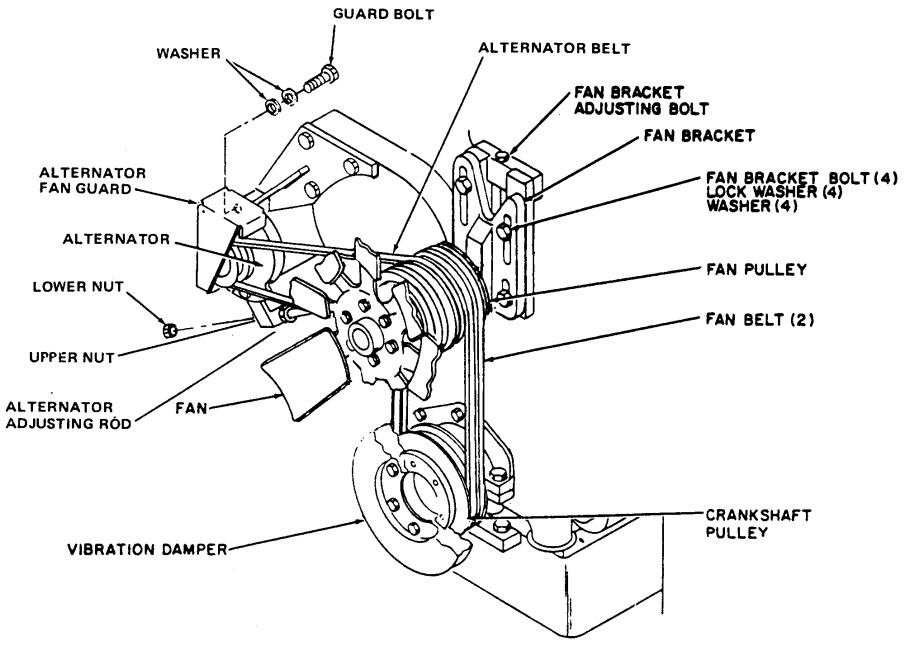
Step 3: Check belts for proper tension, adjust the belt(s) if tension is incorrect

NOTE: Test belt tension by placing approximately 25lb. of force midway between the driver and the driven pulley, belt deflection should be between 9/16 and 13/16 of an inch

Step 4: Perform functional test

NOTE:
If the belt is one of a matched set replace the entire set to maintain equal tension on all belts. New belts will usually have to be tightened later as they expand after having been installed. Consult the T.O. or manufacturers manual to find out how long after installation they should be checked.

Figure 1, Typical Belt Diagram.



Equipment Drive Belts Adjustment

Adjust Alternator Belt

Step 1: De-energize DC circuit breaker and place 'Battle Short Switch' in the raised position

Step 2: Remove the alternator fan guard (ref. fig. 1)

Step 3: Loosen alternator bolt allowing the alternator to pivot during adjustment

Step 4: Rotate the adjusting nut (located under alternator) until alternator belt deflects 9/16 to 13/16 of an inch while applying approximately 25lb. of force halfway between the crankshaft pulley and the alternator pulley

Step 5: After desired adjustment has been obtained; tighten the alternator bolt

Step 6: Reinstall the alternator fan guard

Step 7: Insure all obstacles are removed

Step 8: Perform functional test

Adjust Fan Belts

Step 1: De-energize DC circuit breaker and place 'Battle Short Switch' in the raised position

Step 2: Loosen the four fan bracket bolts, refer to fig 1

Step 3: Adjust the fan bracket adjusting bolt (located on top of the fan bracket) accordingly

Step 4: Ensure proper deflection is obtained, 1/2 to 3/4 (for new belts) or 7/8 of deflection (for belts that have been operated for more than 30 minutes at rated speed). Check deflection halfway between the driving (crankshaft) pulley and the driven (fan) pulley

Step 5: Tighten the four fan bracket bolts

Step 6: Insure all obstacles are removed

Step 7: Perform functional test

NOTE:
Before performing a functional check, insure that fan does not make contact with the fan guard or radiator shroud. If you can not attain proper tension without clearance between the shroud and the guard you will have to replace the belts.

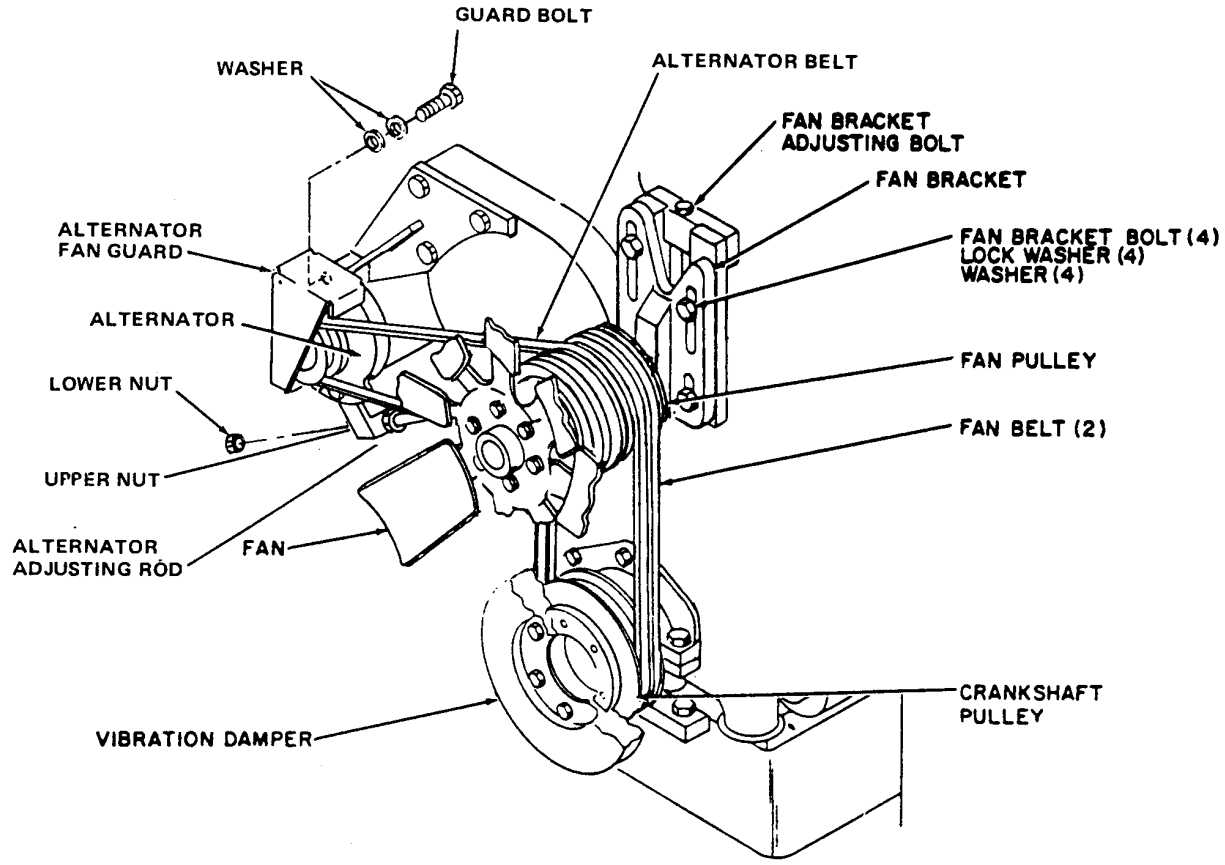


Figure 1, Typical Belt Diagram.

Functional Test

Step 1: Perform a pre-operational check on the generator set

Step 2: Start engine and listen for unusual noise, vibration, or indications belts are making contact with the guard or any other part, if any of these conditions are noted repeat adjustment procedure.

Step 3: Return generator to normal configuration (manual, automatic, etc.).

Step 4: Document actions on AF Form 487 (Emergency Generator Operating Log) and /or AF Form 719 (Historical Record/Diesel/Electric generator and system)

Equipment Drive Belts Replacement

Alternator Belt Replacement

Step 1: De-energize DC circuit breaker and place 'Battle Short Switch' in the raised position

Step 2: Disconnect batteries, IAW. TO 35C2-3-442-11, para. 4-29.b.2

Step 3: Remove the alternator fan guard (ref. fig. 1)

Step 3: Loosen alternator bolt allowing the alternator to pivot during removal

Step 4: Rotate the adjusting nut (located under alternator) until alternator belt is sufficiently loose for removal

Step 5: Remove and replace old belt

Note: Alternator belt should be in first pulley groove forward of the fan belts

Step 6: Rotate the adjusting nut (located under alternator) until alternator belt deflects 9/16 to 13/16 of an inch while applying approximately 25lb. of force halfway between the crankshaft pulley and the alternator pulley

Step 7: After desired adjustment has been obtained; retighten the alternator bolt

Step 8: Reinstall the alternator fan guard

Step 9: Insure all obstacles are removed

Step 10: Don't forget to reconnect the batteries. Connecting the negative battery cable last

Step 10: Perform functional test

Fan Belt Replacement

NOTE:
Fan belts are a matched set and shall be replaced as a set even if only one requires replacing. Fan belts should be positioned in two rear pulley grooves and alternator belt in groove forward of the fan belts

Step 1: De-energize DC circuit breaker and place 'Battle Short Switch' in the raised position

Step 2: Disconnect batteries, IAW. TO 35C2-3-442-11, para. 4-29.b.2. Disconnect negative cable first.

Step 3: Remove alternator belt as stated under alternator replacement

Step 4: Loosen fan bracket bolts and fan guards, refer to fig. 1

Step 5: Rotate fan bracket adjusting bolt and lower the fan bracket until it bottoms and remove adjusting bolt

Step 6: Open battery compartment access door, remove two quick release pins, and pull out batteries using the roll out tray

NOTE:
Pulling out the batteries using the roll out tray will give you the extra clearance you will need to do the job comfortably and will prevent damage that might occur if the fan were to be dropped during removal. If, for example, the fan dropped onto the batteries, one of the blades could make contact with a positive post and another blade could make contact with the engine block shorting out the battery.

Step 7: Support the weight of the fan assembly and remove fan bracket bolts, washers, and lockwashers

SAFETY:
EXERCISE CARE TO PREVENT DAMAGING THE RADIATOR WITH THE FAN DURING REMOVAL OF THE FAN.

Step 8: Move fan bracket away from engine until it can be rotated

Step 9: Rotate bracket 180 degrees so that the short end is even with top of fan pulley
.

Step 10: Remove belts

Step 11: Clean pulleys with non-corrosive cleaner and dry thoroughly

Step 12: Inspect pulleys and fan mounting bracket for breaks, and other damage

Step 13: Install new belts bracket bolts, washers, and lock washers

Step 14: Rotate fan bracket to normal mounting position and secure bracket to engine with fan

Step 15: Install fan bracket adjusting bolt

Step 16: Tighten fan bracket adjusting bolt until fan belts are at proper tension (1/2 to 3/4 inches for new belts)

Step 17: With fan belts at proper tension, tighten fan bracket bolts (4 ea.)

Step 18: Tighten lower adjusting rod nut until alternator belt tension is between 9/16 to 13/16 inches with a 25 lb. force applied midway between the driver (crankshaft) pulley and the driven (alternator) pulley

Step 19: Return alternator belt guard to original position

Step 20: Replace fan guards

Step 21: Don't forget to reconnect the batteries. Connecting the negative battery cable last

Step 21: Perform functional check

NOTE:
Before performing a functional check, insure that fan and/or alternator belts do not make contact with the fan guard or alternator guards.

Review Questions
EQUIPMENT DRIVE BELT
Inspect, Adjust, Replace

Question	Answer
1. What should be de-energized prior to belt inspection? ?	a. Commercial power b. Batteries c. Dc circuit breaker d. None of the above
2. What position should the Battle Short switch be placed in prior to belt inspection?	a. Off b. Remote c. Local d. Raised
3. ? What may be caused by excessive tension?	a. Squalling b. Slipping c. Accelerated belt wear d. Overvoltage
4. What are the general conditions belts are checked for??	a. Scars, frays, improper tension, tears b. Specks, improper tension, slippage, breaks c. Cracks, frays, tears, improper tension d. All of the above
5. How should a matched set of belts be replaced?	a. As each one wears out b. They should be rotated front to back c. Replace the loosest one d. As a set
6. How much force should be applied to the belt to check tension (approximate)?	a. 25 lb. b. 30 lb. c. 45 lb. d. 50 lb.
7. How much force should be applied to the belt to check tension (approximate)?	a. Bottom of belt b. Anywhere on top c. On drive side of pulley d. Halfway between drive and driven pulleys
8. What should you check for after the belt inspection?	a. Unusual noise b. Vibration c. Belt contact with guards d. All of the above
9. What should you check for after the belt inspection?	a. Squealing b. Slipping c. Accelerated belt wear d. All the above

Review Questions
EQUIPMENT DRIVE BELT
Inspect, Adjust, Replace

Question	Answer
10. What should be removed before adjusting belts?	a. Chain b. Chain guard c. Belts d. Belt guard
11. How should matched belts be replaced?	a. Annually b. Only the damaged one c. As a set d. As they fail
12. What adjusts the alternator belt?	a. Lower adjusting nut b. Fan bracket adjusting bolt c. 25 lb. force d. Both b and c
13. What adjusts the fan belts?	a. Lower adjusting rod bolt b. Alternator adjuster c. Fan bracket adjusting bolt d. Pry bar
14. Which pulley is the driving pulley?	a. Alternator pulley noise b. Fan pulley c. Crankshaft pulley d. Camshaft pulley

INSPECT EQUIPMENT DRIVE BELTS

Performance Checklist		
Step	**Yes**	**No**
Did trainee perform the following:		
1. De-energized circuit breaker		
2. Placed battle short in raised position		
3. Checked entire belt for cracks, wear, tares, and frays		
4. Checked for proper tension		
5. Made correct determination as to the condition of the belts		
6. Performed functional check		
7. Reconfigured generator to normal configuration		
8. Documented actions		

ADJUST EQUIPMENT DRIVE BELTS

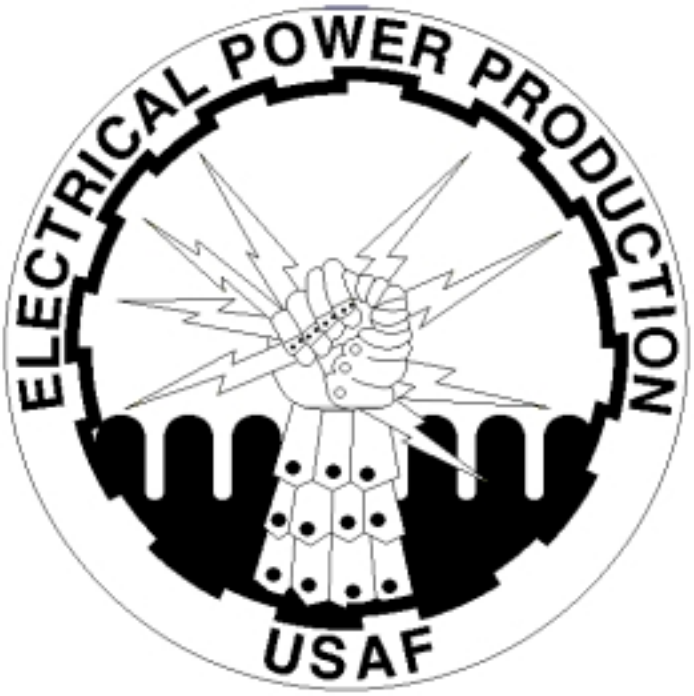
Performance Checklist		
Step	**Yes**	**No**
Did trainee perform the following:		
1. De-energized circuit breaker		
2. Placed battle short in raised position		
3. Disconnected the batteries		
4. Removed belt guard		
5. Replaced belt guard		
6. Made correct adjustment using fan bracket adjusting bolt		
7. Performed functional check		
8. Returned generator to normal configuration		
9. Documented actions		

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

REPLACING EQUIPMENT DRIVE BELTS

Performance Checklist		
Step	**Yes**	**No**
Trainee must complete the following:		
1. De-energized circuit breaker		
2. Placed battle short in raised position		
3. Disconnected the batteries		
4. Pulled out battery tray		
5. Removed fan guard		
6. Removed alternator belt		
7. Loosened fan bracket bolts		
8. Removed fan belts		
9. Cleaned and dry pulleys		
10. Inspected pulleys and fan bracket for damage and cracks		
11. Replaced fan belts as a set		
12. Installed belts on correct pulley grooves		
13. Adjusted fan belts correctly		
14. Adjusted alternator belt correctly		
15. Replaced alternator guard		
16. Re-installed fan guards		
17. Reconnected the batteries		
18. Performed functional check		
19. Documented actions		

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.



EQUIPMENT DRIVE CHAINS

MODULE 13 **AFQTP UNIT 3**

INSPECT (13.3.1)

ADJUST (13.3.2)

REPLACE (13.3.3)

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

EQUIPMENT DRIVE CHAINS

INSPECT
ADJUST
REPLACE

Task Training Guide

STS Reference Number/Title:	13.3.1 Inspect 13.3.2 Adjust 13.3.3 Replace
Training References:	• 35E8 Series Technical Orders.
Prerequisites	• Possess as a minimum a 3E032 AFSC
Equipment/Tools Required:	• General Tool Kit • Applicable Technical Orders or Manufacturers Manual • Personal protective equipment • Bak-12 Barrier System
Learning Objective:	• Inspect, adjust, and replace drive chains on BAK-12 Barrier.
Samples of Behavior:	• Trainee should observe all safety precautions while performing step-by- step procedures for inspecting drive chains.
Notes:	
• Violation of any safety rule or practice will result in immediate failure. • Prior to performing any maintenance, technician MUST isolate the starting system, and apply lockout and tag-out procedures • The material in this AFQTP was extracted from 35C2 Series Technical Orders for the BAK-12 Aircraft Arresting Barrier.	

EQUIPMENT DRIVE CHAINS

INSPECT
ADJUST
REPLACE

Background: Drive chains perform the same function as drive belts but have two definite advantages over drive belts. Drive chains slip less and last longer. These are the primary reasons that chains are used on aircraft arresting systems. However, chains require more extensive maintenance to ensure equipment operates at a peak performance level. . Since chains are made of metal, it is essential to ensure they are in proper serviceable condition to prevent potential damage to other components if they break. Adjustment is usually accomplished by tightening or loosening an idler sprocket, which is sometimes referred to as a chain tensioner. Proper adjustment is critical since an improperly tensioned chain will damage the drive sprocket as well as the driven sprocket, which in turn will damage the chain itself. Once this occurs, the chain and sprockets will deteriorate to the degree that all of the drive components will require replacement. When replacing the chain it is important to inspect the drive, and idler sprockets to ensure they are in good condition . By following these simple instructions you will have a new chain installed that should give you years of reliable service and keep your Power Production equipment performing at peak condition. This QTP has been developed using the BAK-12 aircraft-arresting barrier as a model. Chains may vary by size or design slightly, but the procedures are basically the same for inspecting all chains. Take the time to keep your chains adjusted and lubricated within the tolerances prescribed by the applicable T.O. or manufacturers manual.

SAFETY:
PRIOR TO INSPECTING ANY CHAIN YOU MUST MAKE SURE THE DRIVE SPROCKET OR THE DRIVEN SPROCKET WILL NOT ROTATE DURING THE INSPECTION. YOU MUST WEAR WORK GLOVES WHEN WORKING WITH CHAINS DUE TO THE METAL COMPOSITION OF CHAINS. WHEN WORKING WITH AIRCRAFT ARRESTING BARRIERS YOU MUST ALSO KEEP THE TOWER AND BASE OPERATIONS APPRAISED OF THE BARRIER STATUS AT ALL TIMES.

Inspect Equipment Drive Chains

To perform the task, follow these steps:

Step 1: Set up :
- Disable machine to prevent chain movement.
- Remove chain guard(s).

Step 2: Inspect Chain
- Inspect for cleanliness, grease/grime build up, which occurs when dust or dirt accumulates, or excess oil left on chain. Clean as necessary.
- Inspect for corrosion. Corrosion on chains is normally associated with exposure to moisture such as would be encountered in a location with high humidity. Corrosion that is more than superficial and that cannot be removed easily warrants chain replacement.

- Inspect for proper lubrication. Chains should have a light coat of 10-weight oil on them and should not be dripping with oil. Do not use grease to lubricate a chain. Grease allows dirt and dust to accumulate.

SAFETY:
AT NO TIME WILL CHAINS BE LUBRICATED BY HAND WITH A RAG SATURATED WITH OIL WHILE THE ENGINE IS RUNNING.

- Check for wear. Wear must not only be identified, its cause must also be determined. This requires inspecting other components.
- Check for wear caused by dirt. Dirt accumulation will result in slow but steady wear.
- Check for wear caused by insufficient lubrication. This will result in worn and shiny surfaces on the chain rollers.
- Check for wear caused by improper chain tension. Insufficient chain tension will cause grooving in the chain roller as the gear tooth slams into the roller. Excessive tension will cause wear of the chain as well as causing damage to the sprockets.
- Check for wear caused by damage. Damage to the chain usually comes from a sprocket with bent or broken teeth.

Step 3: Choose corrective action.
- Clean chains.
- Lubricate chains.
- Replace chains/sprockets.

Step 4: Perform Functional Check.
- Start engine and listen for unusual noise, vibration, or indications that chains are making contact with guard.
- Reinstall chain guard.

Adjust equipment drive chains

To perform the task, follow these steps:

Step 1: Set up .
- Disable machine to prevent chain movement.
- Remove chain guard(s).

Step 2: Adjust Chain.
- Loosen or tighten the idler sprocket to obtain the desired deflection as prescribed by the T.O. or manufactures manual for the specific chain you are adjusting. Deflection measurement should be taken at a point halfway between the idler and driven sprocket.

Step 3: Choose corrective action.
- Clean chains.
- Lubricate chains.
- Replace/adjust chains/sprockets.

Step 4: Perform Functional Check.

- Start engine and listen for unusual noise, vibration, or indications chains are making contact with the guard.
- Reinstall chain guard.

SAFETY:
PRIOR TO ADJUSTING ANY CHAIN YOU MUST MAKE SURE THE DRIVE SPROCKET OR THE DRIVEN SPROCKET WILL NOT ROTATE DURING THE INSPECTION. YOU MUST WEAR WORK GLOVES WHEN WORKING WITH CHAINS DUE TO THE METAL COMPOSITION OF CHAINS. WHEN WORKING WITH AIRCRAFT ARRESTING BARRIERS YOU MUST ALSO KEEP THE TOWER AND BASE OPERATIONS APPRAISED OF THE BARRIER STATUS AT ALL TIMES.

Replace equipment drive chains.

To perform the tasks, follow these steps:

Step 1: Set up.

- Disable machine to prevent chain movement.
- Remove chain guard(s).

Step 2: Remove old chain.

- Release tension by loosening the idler sprocket.
- Remove master link retainer with appropriate pliers. Do not pry off with a screwdriver, damaging the retainer will render it useless.
- Remove the master link.
- Remove the old chain from all sprockets.

Step 3: Clean and inspect sprockets.

- Clean all sprockets with non-corrosive cleaner and dry thoroughly.
- Inspect all sprockets for sharp teeth, worn teeth, broken or bent teeth and for wobble.

Step 4: Install new chain.

- Place chain on sprockets with one end of the chain extending just beyond one of the sprockets for ease of handling. Bring the other end of the chain to the end that extends just beyond the sprocket and install the master link.
- Install the master link retainer.
- Tighten idler sprocket to T.O or manufacturer's specifications. Deflection measurement should be taken at a point halfway between the drive and driven sprockets.

Step 5: Perform Functional Check.

- Start engine and listen for unusual noise, vibration, or indications chains are making contact with the guard.
- Reinstall chain guard.

NOTE:
At this point you should have no slack between the drive and the driven sprocket

Review Questions
for
Inspecting Equipment Drive Chains

Adjusting Equipment Drive Chains

Replacing Equipment Drive Chains

Question	Answer
1. What should chains be inspected for?	a. Cleanliness b. Lubrication c. Wear d. All of the above
2. What should chains be lubricated with?	a. Soap b. Petroleum jelly c. 10-weight oil d. Grease
3. Chains may be lubricated while they are moving.	a. True b. False
4. What should be done with chains that have accumulated excessive corrosion?	a. Repair b. Replace c. Clean d. Adjust
5. Damage will usually only be confined to the chain.	a. True b. False
6. What is denoted by shiny rollers?	a. Excessive lubrication b. Insufficient lubrication c. Bent sprocket teeth d. Out of round sprocket
7. Which is an advantage of chains versus belts.	a. Longer life b. Less noise c. No slipping d. Both a and c
8. Where should deflection measurements be taken?	a. Between the idler sprocket and the chain b. Between the driven sprocket and the idler sprocket c. Halfway between the driving sprocket and the idler sprocket d. Halfway between the chain rollers
9. What must be replaced after the chains have been adjusted?	a. Idler sprocket b. Drive gears c. Chain guard d. Chain oil

Review Questions
for
Inspecting Equipment Drive Chains

Adjusting Equipment Drive Chains

Replacing Equipment Drive Chains

10. Who should be notified when an aircraft arresting barrier status is changed?	a. Supervisor b. Control Tower c. Base Operations d. Both b and c
11. Improper tension will only cause damage to the chains?	a. True b. False
12. What should you loosen to release tension on the chain?	a. Driven sprocket b. Driving sprocket c. Idler sprocket d. Gear puller
13. What should be removed to allow you to take off the chain?	a. Master cylinder b. Master link c. Idler sprocket d. Drive sprocket
14. What should be done to the sprockets after the chain has been removed?	a. Honed b. Cleaned c. Polished d. Replaced
15. Why should the two ends of the chain be joined just after a sprocket?	a. Prevent slipping b. To avoid breaking c. Ease of handling d. Both a and b
16. Proper tension is achieved by tightening the idler sprocket.	a. True b. False
17. What is indicated by grooves in the chain roller?	a. Excessive tension b. Insufficient tension c. Excessive lubrication d. Broken teeth
18. What loosens or tightens the chain tension?	a. Driven sprocket b. Driving sprocket c. Idler sprocket d. Gear puller

INSPECTING EQUIPMENT DRIVE CHAINS

Performance Checklist		
Step	**Yes**	**No**
1. Disabled machine		
2. Removed chain guard		
3. Inspected for cleanliness		
4. Inspected for corrosion		
5. Inspected for lubrication		
6. Inspected for wear		
7. Inspected for damage		
8. Inspected for proper tension		
9. Made a determination as to chain condition		
10. Reinstalled chain guard		
11. Returned chain to normal configuration		

ADJUSTING EQUIPMENT DRIVE CHAINS

Performance Checklist		
Step	**Yes**	**No**
1. Disabled machine		
2. Removed chain guard		
3. Adjusted the chain using the idler sprocket to specifications		
4. Took deflection measurements halfway between driven and driving sprockets		
5. Reinstalled chain guard		
6. Returned machine to normal configuration		

REPLACE EQUIPMENT DRIVE CHAINS

Performance Checklist		
Step	**Yes**	**No**
1. Disabled machine		
2. Removed chain guard		
3. Removed the old chain		
4. Cleaned and inspect sprockets		
5. Installed the new chain		
6. Returned machine to normal configuration		

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

GENERAL POWER PRODUCTION TASKS

MODULE 13 **AFQTP UNIT 4**

INTERPRET WIRING DIAGRAMS (13.4)

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

INTERPRET WIRING DIAGRAMS

Task Training Guide

STS Reference Number/Title:	13.4, Interpret Wiring Diagrams
Training References:	• 35C2 Series T.O.
Prerequisites	• Possess as a minimum a, 3E032 AFSC
Equipment/Tools Required:	• MEP Generator Series DC Schematic Diagram • MEP Generator Series Troubleshooting Diagram
Learning Objective:	• Read technical data, trace the crank circuit on a DC schematic diagram. Extract the crank circuit on the DC Troubleshooting diagram.
Samples of Behavior:	• List components from technical data, trace a circuit on the DC Schematic diagram and then trace the circuit on the DC Troubleshooting diagram.
Notes:	
• The correct circuit must be identified with all components traced on the DC Troubleshooting Diagram to satisfy QTP completion. • The material in this AFQTP was extracted from 35C2 Series T.O. for the MEP-007B Generator.	

INTERPRET WIRING DIAGRAMS

Background: Wiring diagrams are the road maps of electrical equipment. Interpreting a wiring diagram correctly separates craftsman that can conquer an electrical problem with a professional, systematic approach, from a craftsman who taps on relays with a screwdriver or replaces relays without knowing whether their condition, hoping to solve the problem without ever finding the cause. Interpreting wiring diagrams may be the most challenging task of a Power Production Craftsman's duties. It is also the most essential task if you are to keep your electrical equipment performing at peak operating conditions.

To perform the tasks, follow these steps:

Step 1: Read Technical Data for Circuit Operation.

- The following is an excerpt from the T.O. for the MEP-007B start circuit. For our purposes we are only concerned with the crank portion of the crank circuit.
- When the START-STOP-RUN switch is toggled to the START position, four actions occur.
- Cranking relay K3 energizes, both engine and day tank solenoids activate
- Fuel pumps B2 and B3 start operating
- Stop-run relay K1 energizes.
- When cranking relay K3 energizes, its contacts close and 24 V dc is applied to and activates start solenoid L4 (mounted on starter motor B1). As a result, B1 cranks the diesel engine, turning it over at 300 rpm.

Step 2: List the Components.

- Go back through the technical data and make a list of all the components mentioned that pertain to the crank circuit.
- The list is as follows:
- S2 (Start-Stop-Run)
- K3 (Crank Relay)
- Batteries (24 Volts dc)
- L4 (Start solenoid)
- B1 (Starter)
- You can also use what you know about the circuit. For instance, you know that you have to push in the CB1 (DC circuit breaker) to let the generator crank and you have to have the Battle Short switch (S7) in the off position to allow the generator to crank. So, go ahead and add those two items to your list.

Step 3. Trace the circuit on the DC Schematic Diagram Figure 1.

- Mark the components on the schematic diagram (pencil to begin with) from the list you made.
- Starting with the power source, in this case the positive side of the battery, follow current flow through the shunt resister. The shunt resistor reduces current flow so it can be measured by the ammeter. Continue to the CB1, if the CB1 is closed current will flow to the S2 Start/Stop/Run switch.
- By holding the S2 in the start position we allow current flow to continue to the S7 Battle Short switch.

- After leaving the S7 current will flow to the normally closed S91 Speed Switch (start disconnect and filed flash)
- Current will continue to flow through the CR3 diode until it reaches the positive terminal on the K3 (crank relay) coil.
- When the coil of the K3 is energized the contacts of the K3 will close allowing battery power to flow to the positive side of the L1 starter solenoid. This will allow the contacts of the L1 to close.
- As the contacts of the L1 close battery power is applied to the starter motor. The starter will start to rotate.

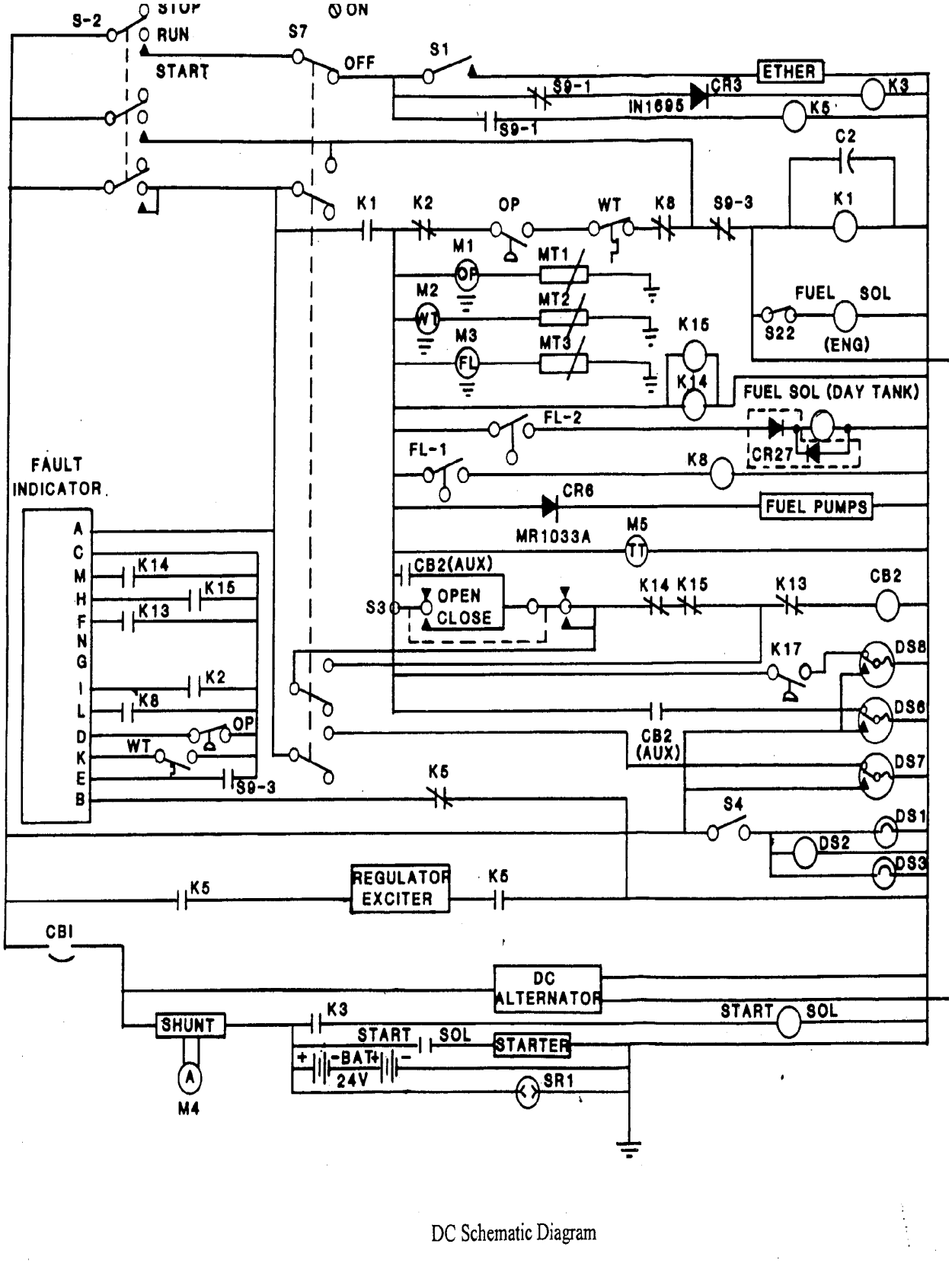
NOTE:
To find out what a component is actually called refer to the Legend on the Diagram to see the name of the component. For example the legend tells you the K3 is called the Crank Relay.

Step 4: Trace the Crank Circuit on the Troubleshooting Circuit.

- Use your schematic diagram Figures 2,3,&4 which gives you a simplified extracted crank circuit to extract the crank circuit on the troubleshooting diagram.
- Remember you will be doing your tracing in exactly the same order as you did on the schematic diagram.
- Mark the components on your troubleshooting diagram.
- Trace the circuit on the DC Troubleshooting diagram Figures 2,3, &4 from the schematic diagram.
- Once you have traced the circuit, you have an extracted circuit that can be used to troubleshoot the crank circuit.

Step 5: Interpret the Circuit.

- The troubleshooting diagram Figures 2,3 &4 gives a multitude of information about the circuit.



DC Schematic Diagram

Figure 1, DC Schematic Diagram

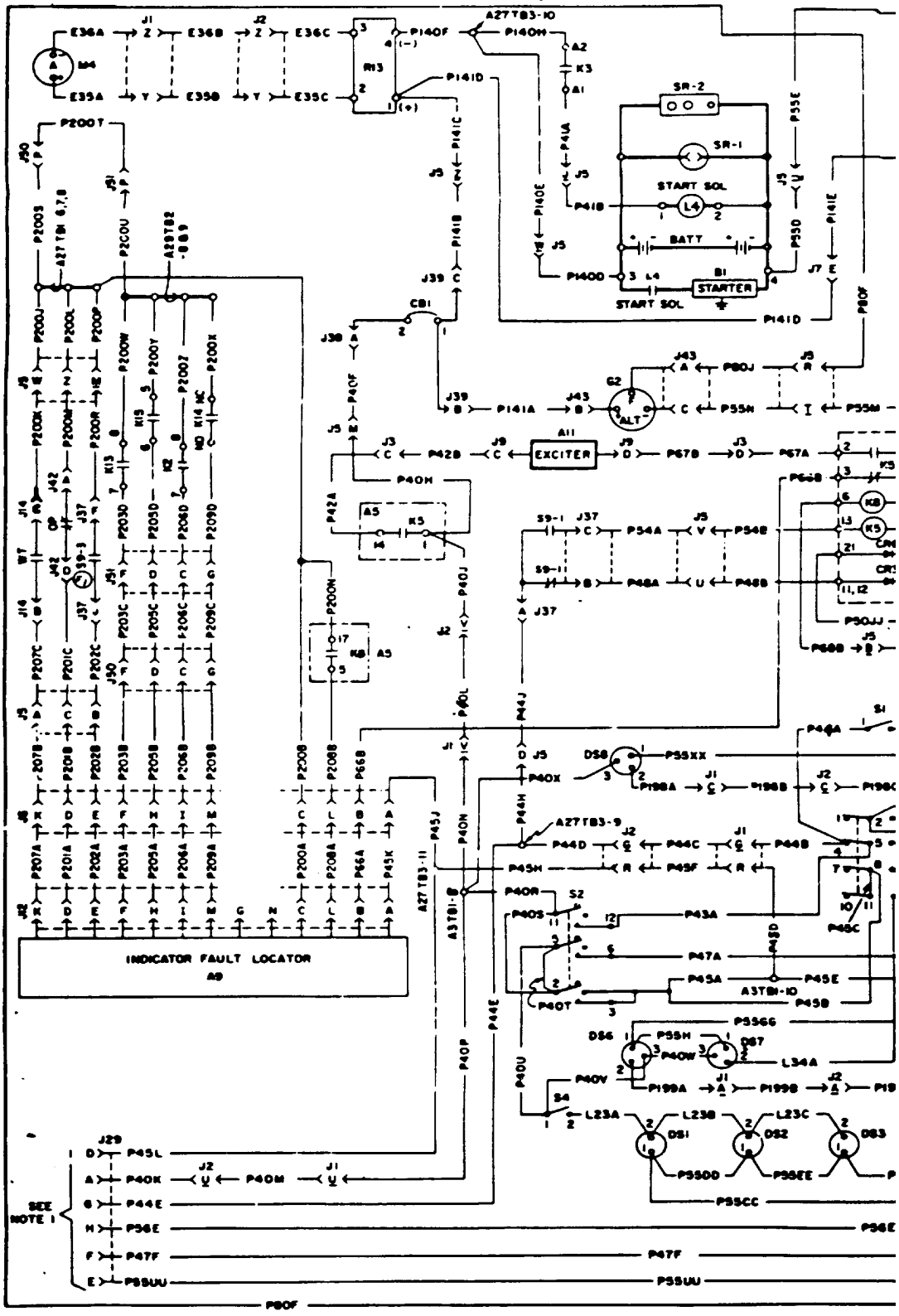


Figure 2, DC Troubleshooting Diagram.

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

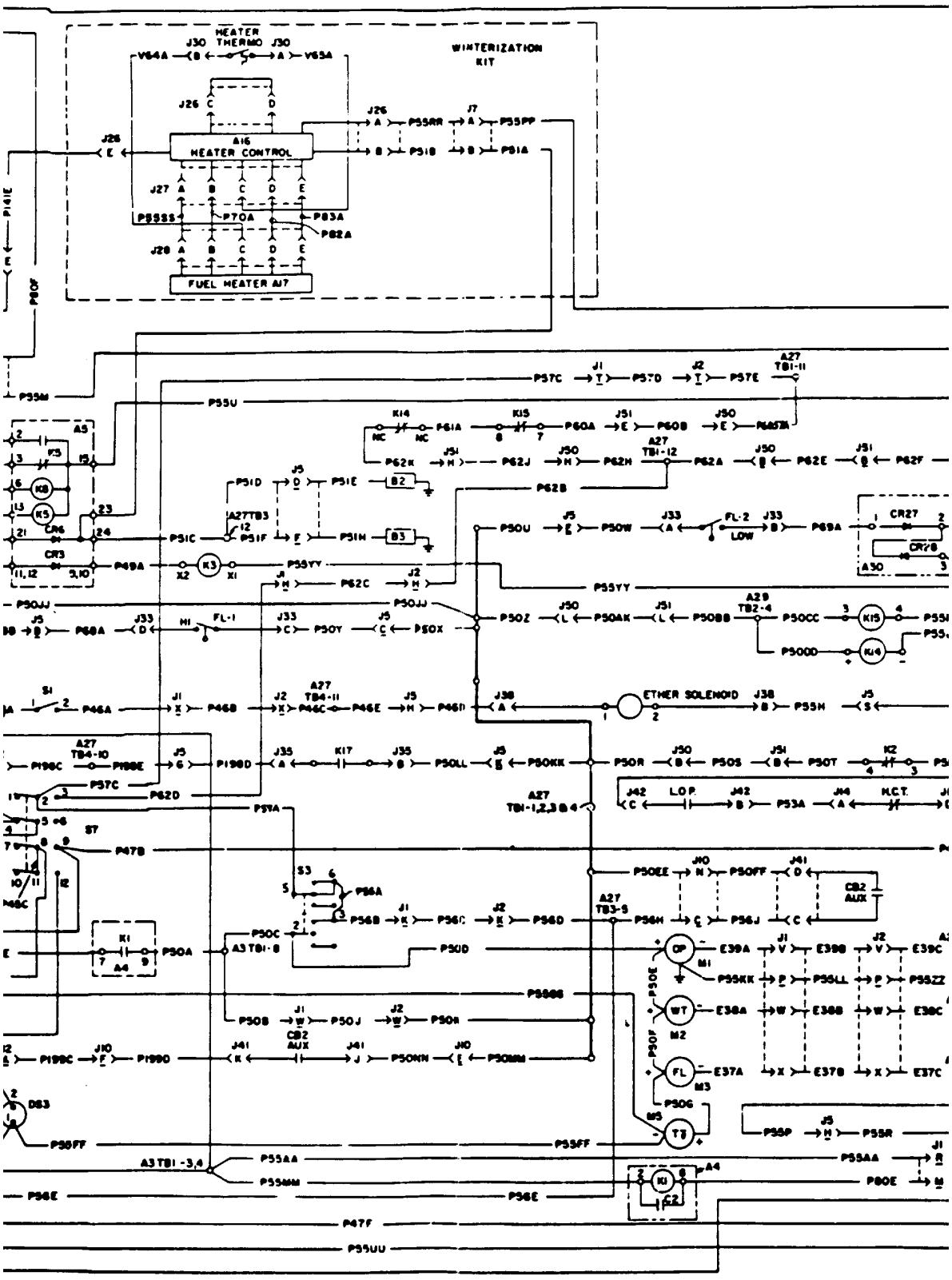


Figure 3, DC Troubleshooting Diagram.

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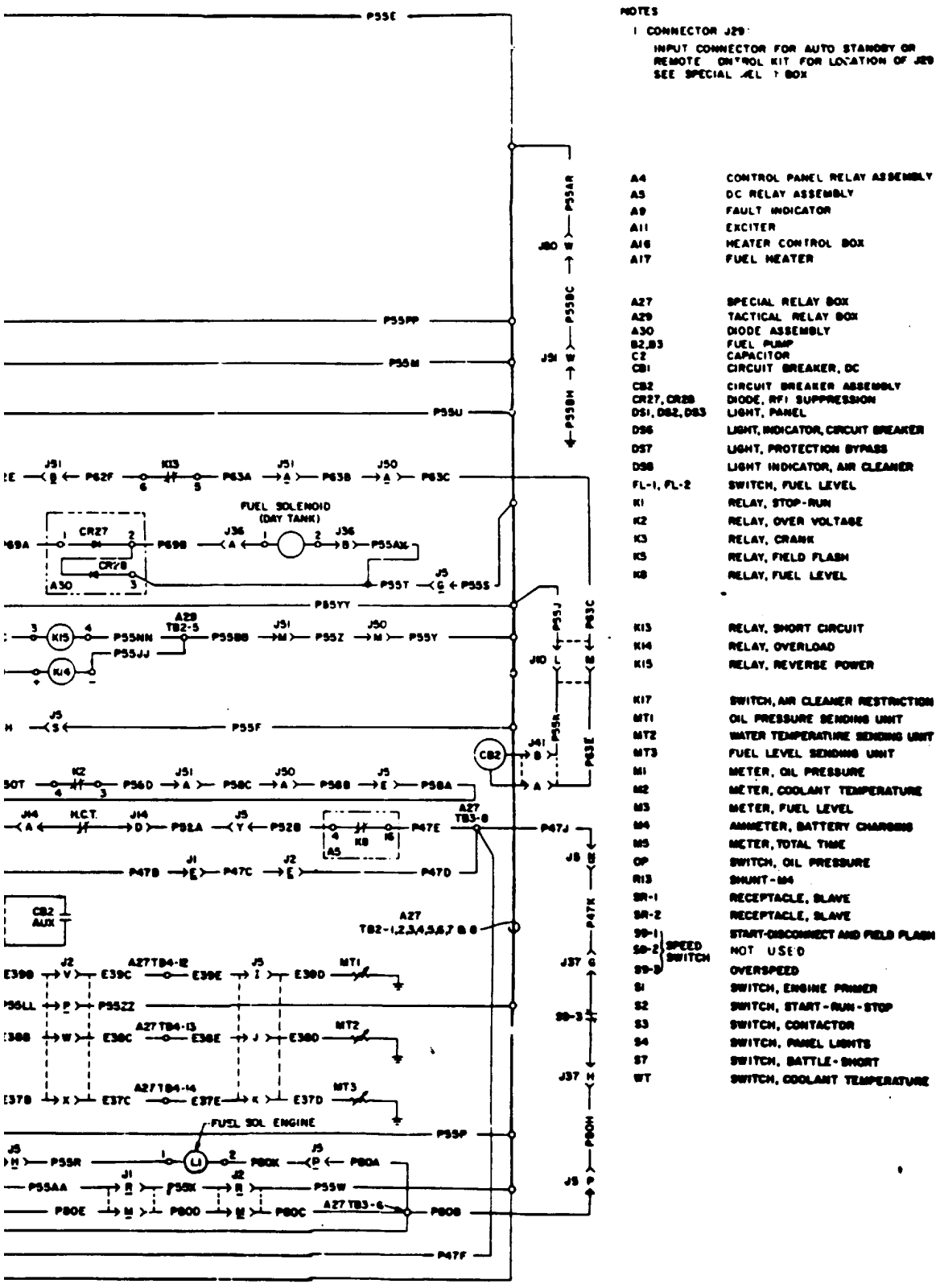

Figure 4, DC Troubleshooting Diagram.

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Review Questions
for
Interpreting Wiring Diagrams

Question	Answer
1. Which diagram shows the simplified circuit?	a. Schematic b. Troubleshooting c. One line d. Connections
2. Which diagram shows wire numbers?	a. Schematic b. Troubleshooting c. One-line d. Connection
3. Which way does electricity travel?	a. North to South b. South to North c. Positive to Negative d. Negative to Positive
4. What is the first step in interpreting a circuit?	a. Trace schematic diagram b. Trace troubleshooting diagram c. Read technical data d. Extract circuit
5. What circuit breaker is a component of the crank circuit?	a. CB1 b. CB2 c. CB3 d. CB4
6. What does S symbolize?	a. Coil b. Contacts c. Lights d. Switch
7. What does K symbolize?	a. Coil b. Relay c. Contacts d. Switch
8. The components on the troubleshooting diagram are traced in reverse of the schematic diagram?	a. True b. False
9. What does a P55 wire on a MEP Generator indicate?	a. Hot wire b. Cold wire c. Neutral wire d. Ground wire
10. On a troubleshooting diagram what indicates the pins in a cannon plug?	a. Y b. Arrow c. P d. J

INTERPRET WIRING DIAGRAMS

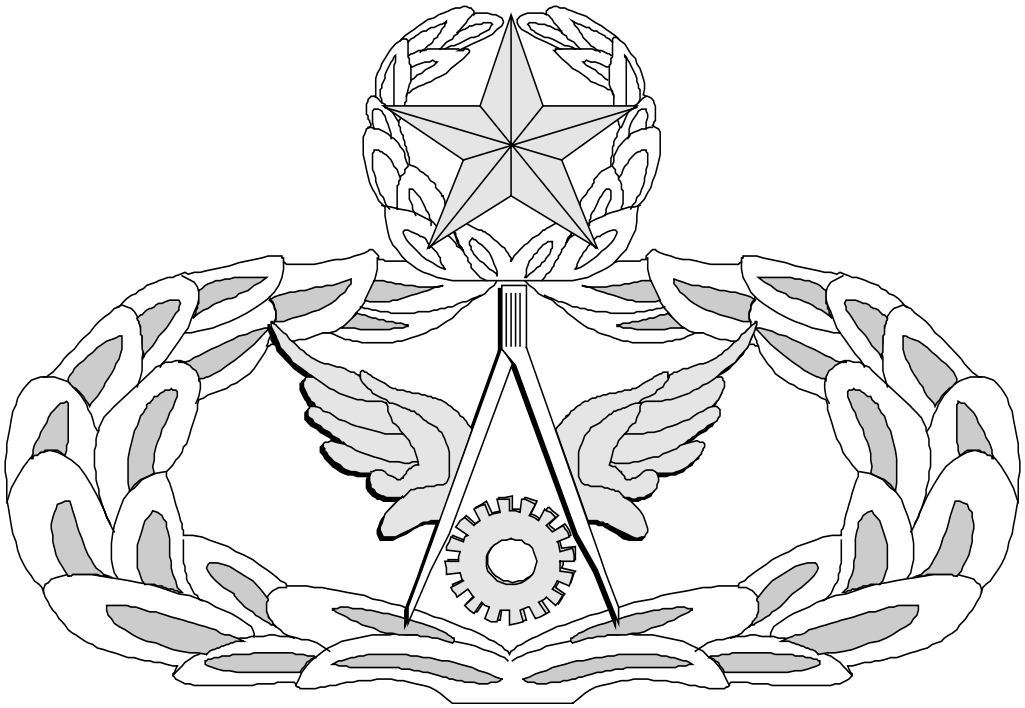
Performance Checklist		
Step	**Yes**	**No**
1. Read technical data		
2. Listed all components		
3. Traced crank circuit on schematic diagram correctly		
4. Traced diagram on troubleshooting diagram correctly		

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

Air Force Civil Engineer

QUALIFICATION TRAINING PACKAGE (QTP)

REVIEW ANSWER KEY



For
ELECTRICAL POWER PRODUCTION

(3E0X2)

MODULE 13

GENERAL POWER PRODUCTION TASKS

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INSPECT EQUIPMENT DRIVE BELTS

(3E0X2-13.2.1)

ADJUST EQUIPMENT DRIVE BELTS

(3E0X2-13.2.2)

REPLACE EQUIPMENT DRIVE BELTS

(3E0X2-13.2.3)

Question	Answer
1. What should be de-energized prior to belt inspection?	c. Dc circuit breaker
2. What position should the Battle Short switch be placed in prior to belt inspection?	d. Raised
3. What may be caused by excessive tension?	c. Accelerated belt wear
4. What are the general conditions belts are checked for?	d. All of the above
5. How should a matched set of belts be replaced?	d. As a set
6. How much force should be applied to the belt to check tension (approximate)?	a. 25 lb.
7. How much force should be applied to the belt to check tension (approximate)?	d. Halfway between drive and driven pulleys
8. What should you check for after the belt inspection?	d. All of the above
9. What should you check for after the belt inspection?	d. Both b and c
10. What should be removed before adjusting belts?	d. Belt guard
11. How should belts be replaced?	c. As a set
12. What adjusts the alternator belt?	a. Lower adjusting rod bolt
13. What adjusts the fan belts?	c. Fan bracket adjusting bolt
14. Which pulley is the driving pulley?	c. Crankshaft pulley

INSPECT, ADJUST, REPLACE EQUIPMENT DRIVE CHAINS
(3E0X2-13.3.1 – 13.3.3.)

Question	Answer
1. What should chains be inspected for?	d. All of the above
2. What should chains be lubricated with?	c. 10-weight oil
3. Chains may be lubricated while they are moving.	b. False
4. What should be done with chains that have accumulated excessive corrosion?	b. Replace
5. Damage will usually only be confined to the chain.	b. False
6. What is denoted by shiny rollers?	b. Insufficient lubrication
7. Which is an advantage of chains versus belts.	d. Both a and c
8. Where should deflection measurements be taken?	c. Halfway between the driving sprocket and the idler sprocket
9. What must be replaced after the chains have been adjusted?	c. Chain guard
10. Who should be notified when an aircraft arresting barrier status is changed?	d. Both b and c
11. Improper tension will only cause damage to the chains?	b. False
12. What should you loosen to release tension on the chain?	c. Idler sprocket
13. What should be removed to allow you to take off the chain?	b. Master link
14. What should be done to the sprockets after the chain has been removed?	b. Cleaned
15. Why should the two ends of the chain be joined just after a sprocket?	c. Ease of handling
16. Proper tension is achieved by tightening the idler sprocket.	a. True
17. What is indicated by grooves in the chain roller?	b. Insufficient tension
18. What loosens or tightens the chain tension?	c. Idler sprocket

Interpret Wiring Diagrams
(3E0X2-13.4)

Question	Answer
1. Which diagram shows the simplified circuit?	b. Troubleshooting
2. Which diagram shows wire numbers?	b. Troubleshooting
3. Which way does electricity travel?	d. Negative to Positive
4. What is the first step in interpreting a circuit?	a. Trace schematic diagram
5. What circuit breaker is a component of the crank circuit?	a. CB1
6. What does S symbolize?	d. Switch
7. What does K symbolize?	b. Relay
8. The components on the troubleshooting diagram are traced in reverse of the schematic diagram?	a. True
9. What does a P55 wire on a MEP Generator indicate?	d. Ground wire
10. On a troubleshooting diagram what indicates the pins in a cannon plug?	d. J